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FEDERATED MALAY STATES.

ANNUAL REPORT

ON THE

DEPARTMENT OF AGRICULTURE,
S.S. AND F.M.S..

FOR THE YEAR

1927

BY

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UNITED STATES DEPARTMENT OF AGRICULTURE

TECHNICAL BUREAU

REPORT

DEPARTMENT OF AGRICULTURE

AND LAND

OF THE

1907

TO

THE

UNITED STATES DEPARTMENT OF AGRICULTURE

DATA

FOR THE

1907

1907-1908

CONTENTS.

| | PAGES. |
|---|--------|
| STAFF | 1 |
| ADVISORY COMMITTEE | 1 |
| ADVISORY COMMITTEE (CHINESE AGRICULTURE) | 1 |
| INTRODUCTION | 1- 2 |
| MAJOR CROPS :— | 2- 8 |
| RUBBER | 2- 3 |
| PADI (RICE) | 3- 5 |
| COCONUTS | 5- 7 |
| OIL PALMS | 7- 8 |
| MINOR CROPS | 9-11 |
| SOILS... .. | 11-12 |
| MISCELLANEOUS INVESTIGATIONS | 13 |
| GENERAL | 13-15 |

APPENDICES.

| | |
|--|-------|
| A. STAFF | 16-17 |
| B. SUMMARY OF PADI RETURNS—BRITISH MALAYA... .. | 17 |
| C. ACREAGE OF MISCELLANEOUS CROPS IN MALAYA | 18 |

FEDERATED MALAY STATES.

ANNUAL REPORT OF THE SECRETARY FOR AGRICULTURE, STRAITS SETTLEMENTS AND FEDERATED MALAY STATES, FOR THE YEAR 1927.

STAFF.

The establishment of the Department of Agriculture, excluding the Secretary for Agriculture, comprised 38 European officers, 26 on the Research Staff and 12 on the Field Staff, the latter including three in the Colony and one in Johore. Four of these substantive appointments were not filled. Details are given in Appendix A of this report.

ADVISORY COMMITTEE.

2. The Advisory Committee at the close of the year was composed of the following members:

The Secretary for Agriculture (*Chairman*);

Yang Teramat Mulia Raja Abdul Aziz, c.m.g., Raja Muda of Perak;

Mr. J. W. Campbell;

Mr. L. P. Jorgensen;

Mr. M. J. Kennaway;

Mr. J. Melville;

Mr. W. A. Stanton;

Secretary to Committee, Mr. D. H. Grist.

Mr. D. S. Gardner and Mr. G. E. Henning also served on this Committee during portions of the year.

ADVISORY COMMITTEE (CHINESE AGRICULTURE).

3. The Advisory Committee (Chinese Agriculture) was composed of the following members:

The Secretary for Agriculture (*Chairman*);

The Chief Agricultural Field Officer;

Mr. Khoo Keng Hooi, J.P.;

Mr. Yap Tai Chi, J.P.;

Mr. Yap Tai Seng.

The Chief Agricultural Field Officer was also Secretary to the Committee.

INTRODUCTION.

4. Attention may again be called to a statement made in a former report that the climatic characters of the Peninsula are such as to indicate that it is better suited to the cultivation of permanent, or semi-permanent, than of annual crops.

With the exception of wet padi which, on account of its peculiar requirements, stands apart from other annual cereals, the established crops in this country are nearly all permanent or semi-permanent. These established crops are more numerous than is generally realised. In addition to rubber they consist of coconuts, padi, oil palm, pineapples, tapioca, areca nut, coffee, gambier and fruits.

The importance of extending the areas cultivated with crops other than rubber is generally recognised, and it may be pointed out that all the crops mentioned above admit of varying degrees of extension, combined with improvements in the efficiency of manufacture and in the standard of quality of the market product. The development of tapioca and gambier planting is, however, strictly limited by market requirements, as is that of coconuts by the available area of suitable land.

Among crops under experiment that show some promise of remunerative cultivation under estate conditions are nipah, sisal and mauritius hemp, tea (lowland and upland types), tuba and possibly candlenut. For small holders banana cultivation for local consumption should prove remunerative and there are possibilities in the production of papain, kapok, spices, pepper and ginger, while in some districts the supplies of locally grown fruit and vegetables are sadly deficient.

The peculiar conditions on the East coast, which differ markedly from those on the West, offer possibilities for the successful cultivation of certain annual food crops in rotation with padi and render developments in the rearing of stock and poultry worthy of attention.

MAJOR CROPS.

RUBBER.

5. GENERAL.—As foreshadowed in the annual report of this department for 1926, most of the work connected with rubber was handed over to the Rubber Research Institute of Malaya at the beginning of the year. It was, however, decided that the Field Division should retain all legal powers under the Agricultural Pests Enactment and Ordinance and, in consequence, should remain responsible for ensuring the control of pests and diseases of rubber.

Work on species of *Pythium* and *Phytophthora*, causing such diseases of rubber as black stripe, patch canker, pod rot and leaf fall, has been continued by the Mycological Division, since it forms an essential part of a more general study which has been in progress for some time. This study concerns certain Malayan species of the above genera and their relationships to the similar species responsible for well known diseases of major crops throughout the tropics.

In the first half of the year some outstanding chemical investigations on *Hevea* latex were completed to a stage at which the results then obtained could be published. After the appearance of these results in the *Malayan Agricultural Journal* the work was discontinued.

Importation of bud wood from selected trees in Sumatra and of selected seed from Sumatra and Java has continued throughout the year.

6. DISEASES AND PESTS.—PINK DISEASE (*Corticium salmonicolor*). This disease was very little in evidence during the year. Its control received attention in those areas where it is endemic, especially the Batang Padang and Lower Perak districts of Perak, Ulu Selangor district of Selangor, where it gave some trouble in the first quarter of the year, the Bahau and Seriting areas in the Negri Sembilan and certain parts of Segamat district and Central Johore generally. In Pahang West it gave little indication of doing any material damage, but its control was regularly enforced.

DIEBACK.—In the rubber areas of South Johore and the Johore River the dying back of the top branches of rubber trees has been a noticeable feature during the past few years. This dieback was observed to be closely connected with unfavourable soil conditions, but it was thought that damage might also be due in some measure to parasitic fungi. The problem was considered sufficiently important to be referred to the Rubber Research Institute. It was investigated by the Plant Pathologist of the Institute, who reported that the trouble was a direct result of the exhaustion of food supply, coupled with adverse physical conditions of the soil and exposure, and that the fungi found on the dying branches might be considered to be purely secondary. The problem in this locality consequently becomes one of improving the growing conditions of the trees and not one dealing with the primary activities of fungi.

MOULDY ROT (*Sphaeronema fimbriatum*).—This was efficiently controlled everywhere, though virulent outbreaks during wet weather required close attention in Selangor and on Singapore Island. There has been no great increase in the area affected, but the disease spread to some extent in Singapore Island and along the Eastern boundary between Province Wellesley and Kedah. Minor new outbreaks occurred in Penang, in the Northern district of Province Wellesley, and in two localities in Kuala Kangsar district of Perak. In Pahang West, especially the districts of Kuala Lipis and Temerloh, there was a notable decrease of cases of this disease due to the enforced cessation of tapping during and after the floods.

Attempts to inoculate with this disease the tapping cuts of certain rubber trees in the Experimental Plantation, Kuala Lumpur, were unsuccessful. This result is similar to that obtained from inoculation experiments made in 1918 on these trees. Inoculations of this fungus into sweet potato tubers also gave negative results, although the species was first described from material obtained on sweet potato in America.

UNIDENTIFIED.—At the beginning of the year another bark rot was found on a holding in Penang. Its effect was similar to that caused by Mouldy Rot, but it differed from the latter disease in that the rot developed at a height of three or four inches, instead of one quarter of an inch, above the tapping cut. No trace of *Sphaeronema fimbriatum* was found on specimens sent to the Rubber Research Institute. The same treatment as is used for Mouldy Rot was successfully applied.

PATCH CANKER.—Many cases of a patch canker were found on old trees in low lying situations after the heavy rains early in the year. Although in some cases the rot had extended over large areas of the inner bark, no case of the death of a tree is known to have occurred. The wounds made healed up with the advent of dry weather in some instances without any treatment, in others after the dead tissue had been cut away and the wounds had been cleaned.

The general investigations on species of *Phytophthora* and *Pythium*, mentioned above, have shown that two species of the former and one of the latter genus are capable of causing patch canker in varying intensity. One of the species of *Phytophthora* is *P. faberi* (Mauhl.), which causes Black Stripe disease of the tapping cut. The other bears a close resemblance to *P. nicotianae* (Van Breda de Haan) and is very virulent, producing a large cankered patch in seven days, if inoculated on to unwounded virgin bark and kept moist. The *Pythium* is identical with a species isolated from a disease which appeared on rubber pods late in 1924, but which has not since been noticed.

FRUIT AND LEAF DISEASES.—In December a few pods fell, while yet green, from a tree in Kuala Lumpur. These were found to be diseased at the stalk end. Cultures resulted in the growth of a species of *Phytophthora* which produces little aerial mycelium, but forms abundant oospores of the "parasitica" type.

Results so far obtained indicate that this *Phytophthora* is not a vigorous parasite on the young leaves of *Hevea*, although in South India and Ceylon related fungi producing pod-rots are also responsible for the important "secondary leaf fall" disease. In pure cultures the *Phytophthora* sp. under consideration differs somewhat from *P. meadii* (McRae), which causes secondary leaf fall in South India, and is quite distinct from *P. faberi* (Mauhl.), which causes the trouble in Ceylon.

ROOT DISEASES.—After the floods in Pahang rubber trees in low lying situations often stood in water for a few weeks. As a result the bark of the roots and basal two or three feet of the trunks became sickly. When the water subsided borers entered the unhealthy bark and were followed by the fungi *Kretzschmaria micropus* and *Ustilina maxima* which in many instances caused the death of the trees. In Perak South, one estate has adopted the control measures for Wet Rot (*Fomes pseudoferreus*) recommended by the Mycologist and referred to in last year's report.

ORGYIA TURBATA.—Considerable attention was paid to the migration of this insect from *Mimosa pudica* to young rubber plants in Province Wellesley. A detailed report was published in the *Malayan Agricultural Journal*, Vol. XV, No. 7. A similar migration of this insect from a cover crop of *Centrosema Plumieri* to young rubber was recorded in Selangor during 1926.

7. CHEMICAL INVESTIGATIONS.—As stated above, investigations in progress on *Hevea* latex were completed to a stage suitable for publication. The results appeared in the *Malayan Agricultural Journal*, Vol. XV, Nos. 2 and 8. They showed that the initial changes in the rate of vulcanisation of rubber from preserved latex are not accounted for by the hydrolysis of the proteins in the latex, but that the variation in the rate of vulcanisation is probably associated with changes in its fatty acid content.

PADI (RICE).

8. AREA AND CROPS.—The area planted with "wet" rice for the 1927 harvest was stated to be 158,862 acres in the Federated Malay States and 558,673 acres in the whole of Malaya. The corresponding crops reaped are given as 21,425,665 gantangs (gallons) and 118,022,267 gantangs, respectively. The Peninsula also produced 8,943,618 gantangs of "dry" padi from 77,351 acres of which 57,050 acres were in Kelantan. Statistics of the crop are given in Appendix B.

Except in Perlis, Kedah, Penang, parts of Kuala Kangsar district unaffected by floods, and Malacca, padi crops were bad. Drought in many localities rendered planting late and irregular. In the later stages of growth severe floods caused extensive damage to the standing crop, more especially along the Perak River, in Pahang and in Kelantan, where in many padi areas the entire crop was washed away. In Province Wellesley and Krian wet weather during the late harvest increased the damage caused by floods. Much grain was lost, after it was cut, owing to

continual showers which caused it to germinate and rendered it useless for milling. Rats too were exceptionally destructive everywhere as a consequence of the floods. In Krian the crop only amounted to 9,493,654 gantangs of padi, or approximately 68 per cent. of the average yield obtained during the last fifteen years.

Owing to the destruction caused by the floods it was necessary to distribute over 95,000 gantangs of seed padi for planting during 1927. Most of this was sent to Pahang and parts of Perak along the Perak River, but a large consignment of selected seed was also sent to Kelantan. Drought again resulted in late and irregular planting in several parts of the country, but at the end of the year it seemed probable that, if the weather were dry for harvest, a fair average crop might be expected for the season 1927-1928 from the Peninsula as a whole, although prospects varied greatly in different districts. It is noteworthy that in Pahang the detritus deposited by the floods proved very suitable for wet padi and that yields much in excess of the average were being obtained from it at the close of the year. The cultivators worked hard in the face of heavy odds. Consequently, although the area planted is not so extensive as usual, a heavier crop of padi is likely to be harvested in that State than even the most optimistic expected.

9. SELECTION WORK.—Pure line selection work was continued at the Titi Serong Rice Experiment Station along the lines already laid down. Unfortunately the 1927 figures are of little value for computing results owing to extensive damage by floods. At the Pulau Gadong Station, Malacca, progress was made in the selection of high yielding pure strains of the popular local varieties Nachin Puteh and Padi Siam, rats being less destructive to the important selection plots than they were to other plots at this Station.

Further evidence of the wide distribution of seed of selected strains was gained by visits to several padi areas during and after harvest, and by examining exhibits at various Agricultural Shows at which it was observed that the selected strains took numerous prizes. Even in Kelantan, where two gantangs of seed of each of two strains were introduced by private enterprise in 1922-1923, it was found that both strains were popular amongst cultivators, though the strains had become somewhat mixed.

10. CULTIVATION AND MANURING.—The unfavourable 1926-1927 season rendered much of the experimental work on padi barren of results. The crops at the Talang Test Station, Kuala Kangsar, and at the Dong Test Station, Pahang, were entirely destroyed by floods. Drought practically destroyed the "dry" padi on the trial plots at the Pekan Station in Pahang, while the inclement weather throughout the season resulted in practically the complete failure of the Bota Test Station in Perak and rendered unreliable the records obtained from the plots at Titi Serong and at the Pekan Darat Station in Province Wellesley. At the Pulau Gadong Station in Malacca rat damage interfered with the experiments, since these animals at times invaded the plots in such numbers that the usual control measures were ineffectual.

11. RICE STORAGE.—In view of the reliance of Malaya on imported supplies of rice, it is desirable to obtain information on the possibilities of storing rice and padi, in order to tide over any temporary embarrassment. For this purpose an experimental rice store was erected. It is expected that experiments will be commenced early in the coming year.

12. PESTS AND DISEASES.—Padi Fly (*Leptocoris* spp.) M. Pianggang or Chenanggau. These insects did little damage during the 1927-1928 season. They were found on grasses in the Kuala Pilah and Tampin districts of the Negri Sembilan, and along the Pahang River on the sedges that grew thickly on the deposits left by the floods. Early measures were taken to destroy them. Investigations of the economic importance and control of the different species have been completed and the results are being prepared for publication.

Sogata pallescens.—This Delphacid bug, which did considerable damage to the padi crop at the close of 1925, was reported again during the first two weeks of December from Kedah, Province Wellesley, the Krian, Larut, Upper Perak, Kuala Kangsar and Lower Perak districts of Perak and from the Negri Sembilan; its attacks varied greatly in intensity. It was universally present on padi in Krian and Larut districts, though usually most numerous in fields where the water was stagnant. Draining off the water from all areas where this was practicable and replacing it with fresh water proved a successful measure of control, although in a few instances in Krian the water had to be changed a second time to ensure complete success. During showery weather in the second half of the month the pest again disappeared almost as suddenly as it had developed. Its influence on the crop is likely to be slight, as the

padi was attacked when young and had sufficient time to recover before harvest. Little has yet been learnt about the life history and habits of *Sogatia pallescens*, since the short duration of its outbreaks has afforded little opportunity for its study and the individuals soon die under artificial conditions in the laboratory.

The Pentatomid bug *Scotinophora coarctata*, M. Kutu Bruang or Bena Kura, did some damage in parts of Pahang and also in Lower Perak. Flooding the fields is the only effective control at present known for this insect, but water was not available for this purpose in most of the areas affected. The case-worm *Nymphula depunctalis* damaged nurseries in parts of Malacca and Province Wellesley, while in the latter Settlement some nurseries were also attacked by Noctuid caterpillars, *Spodoptera* spp. Stem borers were responsible for some damage to late planted padi in the Province towards the close of the year.

SCLEROTIAL DISEASES.—A strain of *Sclerotium Rolfsii* was found on padi seedlings in Province Wellesley. It was shown to be parasitic on young plants, but should not give trouble in the nurseries, if the rice is properly grown. Another sclerotial fungus appeared on mature plants in Krian following the Delphacid pest *Sogatia pallescens*. The fungus only became evident when the water was drained off the fields and apparently did not do much damage.

Rats again did considerable damage in parts of Malacca, the Negri Sembilan and Lower Perak.

13. RAT CAMPAIGNS.—The special rat campaign was continued in Krian during 1927. As a result 842,791 rats were destroyed as compared with 673,102 in the previous year. In early December some damage was found in two mukims and in consequence 12,000 balls of poisoned bait were prepared and rapidly distributed. This distribution was being continued at the rate of about 1,000 balls a day at the close of the year. Practically no further rat damage is known to have occurred since this additional action was taken. In view of the success attained in Krian and of the extensive damage done to the crop in Province Wellesley in the 1926-1927 season, a rat campaign on similar lines to that in Krian was started in the Province in August. The results obtained are considered satisfactory, over 100,000 rats having been killed between the 1st September and the end of the year.

14. GREEN DRESSING EXPERIMENTS ON SLIMED LAND.—On the area at Kamunting opened in July, 1926, *Tephrosia candida* and *Crotalaria anagyroides* have made excellent growth. On the area opened in December, 1926, *Mimosa invisa* has done well.

15. PADI COMPETITION.—A scheme for a padi competition was put into operation in Province Wellesley. There were 142 entrants. The experiment has emphasised the great difficulty of conducting padi competitions, owing to the very large amount of work entailed in judging. It is felt that the work involved is out of proportion to the results likely to be achieved and that other methods of encouraging padi cultivation are likely to prove more efficient.

COCONUTS.

16. AREA.—The area planted with coconuts in the Federated Malay States is estimated at 168,000 acres and the total planted area in the Peninsula at 500,000 acres.

17. MARKETS.—The market for copra which, at the end of 1926, closed at \$10.10 per picul (133½ lbs.) rose in January to \$11.00. The price during 1927 showed no great variation until October when it rose to \$11.53 per picul, declining at the end of the year to \$11.50 per picul. The average price throughout the year was \$11.17 per picul, as compared with \$11.80, \$11.95 and \$12.12 in the years 1926, 1925 and 1924, respectively.

18. EXPORTS.—The exports of copra from the Federated Malay States for 1924 to 1927 are shown in the following table:

| State. | Quantity in tons. | | | | Value in dollars. | | | |
|-------------------|-------------------|--------|--------|--------|-------------------|------------|------------|------------|
| | 1924. | 1925. | 1926. | 1927. | 1924. | 1925. | 1926. | 1927. |
| Perak ... | 38,545 | 40,007 | 44,542 | 39,499 | 6,914,055 | 7,830,274 | 8,905,033 | 6,862,402 |
| Selangor ... | 12,900 | 15,426 | 16,963 | 14,120 | 2,427,188 | 2,909,119 | 3,212,553 | 2,615,641 |
| Negri Sembilan... | 1,179 | 2,236 | 3,417 | 3,302 | 203,930 | 463,494 | 575,451 | 562,528 |
| Pahang ... | 560 | 315 | 907 | 615 | 95,839 | 57,412 | 158,733 | 102,255 |
| Total F.M.S. ... | 53,184 | 57,984 | 65,829 | 57,536 | 9,641,012 | 11,260,299 | 12,851,770 | 10,142,826 |

The net exports of copra from British Malaya during the last three years were:

| Year. | | | | | | Quantity in tons. | Value in dollars. | |
|-------|-----|-----|-----|-----|-----|----------------------|----------------------|------------|
| 1925 | ... | ... | ... | ... | ... | 96,554 | ... | 19,093,938 |
| 1926 | ... | ... | ... | ... | ... | 104,653 | ... | 21,852,330 |
| 1927 | ... | ... | ... | ... | ... | 86,649 | ... | 16,562,493 |

19. GENERAL.—The feature of the year has been the marked decrease in copra production. The export figures for the Federated Malay States show a drop of 12 per cent. as compared with those of 1926, while the net export from Malaya in 1927 was 18 per cent. below that of the preceding year. It is considered probable that the drought in 1926 accounts for this reduction of yield. The consensus of opinion is that the copra content of nuts has been low, while in some districts it has also been reported that fewer nuts have been harvested.

The estimated increase in the planted area during the last twelve years is insufficient to account for the increase in the exports of copra from 7,700 to 65,800 tons. The probable explanation is that extensive planting must have taken place during a few years prior to 1914, that this period of rapid expansion then terminated and that the subsequent steady increases in exports of copra have been mainly due to normal increases in yield obtained from the trees planted during the period of expansion and, in addition, to improvements in methods of drainage and cultivation. While further annual increases in copra production may occur, as the palms in the existing planted area attain full maturity, any great expansion of the copra industry in Malaya is possibly not to be expected, owing to the difficulty of finding additional large areas of suitable land.

20. EXPERIMENTAL INVESTIGATIONS.—The individual yields of 530 palms were recorded monthly for the seventh year in succession and have provided instructive information on the extent to which individual palms on commercial plantations differ from one another in their average annual yields. In the case of 25 of the heavy yielding palms, the average copra content per nut of each was determined and it was found that in this respect also there is a wide range of variation. The results published in the *Malayan Agricultural Journal*, Vol. XV, page 387, emphasise the utility at the present time of selecting nuts for seed purposes from palms known to give high yields of copra, and also indicate the valuable increase in copra production per acre that may ultimately be obtained by selection.

At the Coconut Selection Station, Klang, the planting of the 50 acre block with selected types was completed and arrangements were made to secure an additional area of about 17 acres for an extension of planting. The palms have continued to make satisfactory progress. A comprehensive series of manurial experiments is being made at this station, while experiments in methods of cultivation and the use of cover and catch crops have also been commenced.

The reputed inferiority of Straits copra as compared with that produced in Ceylon and Malabar appears to be a matter of importance to the local coconut industry. This reputed inferiority is being made the subject of chemical investigations. Climatic conditions are not wholly responsible and it is hoped that an improved reputation can eventually be made. Work in progress comprises a study of local methods of preparing copra, together with analyses of a number of samples of fresh and stored copra, in order to determine the range of variation in the oil content of the Straits product. Oil content, being a character of considerable importance to millers, may be expected materially to influence the market price.

21. DISEASES AND PESTS.—BUD-ROT—There were no cases of epidemic bud-rot during the year. The situation with regard to those affections which, in this country, end with the death of the bud, is much the same as was reported in 1926.

A number of young palms were inoculated with strains of *Phytophthora faberi* isolated from coconut, cotton, rubber and cacao. Success was obtained in only one case with a *P. palmivora* strain isolated from coconut in India. Further work on *Phytophthora* bud-rot is contemplated, as the unusually dry period following the inoculations may have mitigated against a more uniform success.

SALMON PINK DISEASE AND LIGNIFICATION OF THE STEM.—A few fresh cases occurred in the coastal areas where the trouble took the form of a salmon pink discoloration and softening of the central stem tissues accompanied, in most cases, by a hardening and lignification of the outer tissues. No large area was affected in any one place,

a group of from 15 to 30 palms usually becoming attacked. Examination of soil samples from infected areas did not lead to the correlation of any particular soil factors with the incidence of these diseases, though on coastal estates the salmon pink form is usually most active in patches of land difficult to drain.

As was the case in 1926 a few fructifications of *Polyporus ostreiformis* were found in association with these diseases. A number of palms were inoculated with this fungus obtained from diseased material, but no success can so far be recorded. The palms available for these inoculations were growing in light sandy soil, but, as the soft salmon pink form of disease has only been found on heavy clay soils, preparations for further inoculations on palms growing in such soils are being made.

Marasmius sp.—In the report for 1926 reference was made to the attacks of this fungus on the trunks of certain young dwarf coconuts on an estate in Perak. Early in the present year several palms on this estate developed a rot of the cabbage, which was found to be caused by the same fungus. In these cases the mycelium was present in large quantities in the bases of the stalks of affected leaves. The attacked palms were growing on somewhat unsuitable land.

Artona catoxantha.—Only one small outbreak of this insect was reported during the year. This occurred on a small holding at Sabak Bernam, Selangor, in June.

THE GREATER SPIKE MOTH (*Tirathaba* sp. nr. *trichogramma*).—Considerable attention has been paid to the biology and economic status of this insect, but progress has been slow and little can be added to the statement made in the last annual report. The results so far obtained are, however, being prepared for publication in the coming year. Enquiries concerning the parasites of this moth have been received from Fiji. Three parasites have been identified, the chief being the Tachinid, *Hemimaticera basifulva*.

BLACK BEETLES (*Oryctes rhinoceros*) AND RED STRIPE WEEVILS (*Rhynchophorus schach*).—These have been kept well under control as a result of routine inspections and the enforced destruction of suitable breeding grounds.

Setora nitens.—Caterpillars of this insect caused trouble at the beginning of the year on young plantations. Outbreaks would appear to be associated intimately with climatic conditions, since on previous occasions serious damage inflicted by these caterpillars on young coconuts has been reported after heavy rains.

MISCELLANEOUS INSECTS.—Outbreaks of the skipper, *Hidari thrax*, and of the Nymphalid, *Amathusia phidippus*, also occurred. The latter has apparently not been reported on any previous occasion as causing extensive damage.

OIL PALMS.

22. AREAS CULTIVATED.—While no sensational development of this new industry was made during the year, the progress of planting and the general development of estates has proceeded unchecked. There are now twenty-four oil palm estates, an increase of five over those in existence in 1926. Of these, three estates have over 2,000 acres planted and ten estates have between 400 and 800 acres planted. The total area planted with this crop in Malaya is 18,321 acres. The reserve land held by oil palm estates amounts to 18,500 acres. The areas of land provisionally reserved for this cultivation in the Federated Malay States, but not yet alienated, contain about 118,000 acres. It is not, however, yet known if they are all suitable for oil palm. The principal planted areas are distributed as follows:

| | Perak. | Selangor. | N. Sembilan. | Johore. |
|-------|--------|-----------|--------------|---------|
| Acres | 1,516 | 11,075 | 600 | 5,130 |

23. PRODUCTION.—The yields in tons of palm oil and kernels in Malaya since the commencement of the industry have been:

| | 1923. | 1924. | 1925. | 1926. | 1927. |
|----------|-------|-------|-------|-------|-------|
| Palm oil | 195 | 286 | 536 | 751 | 915 |
| Kernels | 50 | 81 | 110 | 168 | 185 |

There are now four up-to-date oil extraction plants erected on Malayan estates, an increase of two during the year under review.

The imports and exports of palm oil and kernel are now included in the official monthly returns published by the Registrar of Imports and Exports. The figures for 1927 place the net export value of oil palm products at \$274,061.

A considerable increase in total crop is anticipated in 1928, as new areas will come into bearing, and machinery on two estates will for the first time have worked throughout the year.

24. **MARKETS.**—The price of the African products at the beginning of the year stood at about £39 per ton for palm oil and £20 per ton for kernel. A drop of about £6 per ton for palm oil was experienced about the middle of the year, due to the report of expected large increases in supplies of cotton seed oil. The price had recovered to about £36 per ton by December. The Malayan palm oil realised prices in advance of those quoted for the supplies from Africa. The market for palm kernels has been steady throughout the year, closing at slightly higher prices.

25. **GENERAL.**—All the information at present available concerning the oil palm in Malaya was published in the *Malayan Agricultural Journal*, Vol. XV, Nos. 9 and 10 and was also issued as Special Bulletin No. 39.

26. **CULTIVATION.**—The investigations in progress at the Government Experimental Plantation, Serdang, concerning the subjects detailed in the last annual report, are being continued. Any results available have been published as stated above.

27. **EXPERIMENTAL INVESTIGATIONS.**—The development of the oil palm industry has given rise to a number of problems concerning the efficient production of a high grade oil from the pericarp. Assistance has been given to estates in improving the efficiency of the centrifugal oil extraction process and data relative to the local preparation of palm oil have been collected. The results so far obtained have been published as stated. Further work is in progress.

In order to determine the consumption by the oil palm of the important soil constituents, nitrogen, potash and phosphates, analyses have been made of a series of samples of the leaves and male flowers collected from palms growing in different localities. Further analyses of samples of the fruits and fruit stalks are being undertaken.

A preliminary survey of the various types of oil palm growing at the Experimental Plantation, Serdang, is in progress. This indicates that the range of variation in this crop is sufficient to render profitable the selection of the best type of palm for plantation purposes.

The collection of new varieties from East and West Africa, now becoming well established at Serdang, will increase the material available for selection work.

28. **DISEASES AND PESTS.**—On the whole oil palms have been fairly free from any serious diseases or pests during the year. Crown disease has, however, continued to give some trouble on areas of young palms. When the palms reach three years of age, the number of cases diminishes. The characteristic symptoms may be a result of too rapid growth, induced by excess of some nutritive element in the soil.

A few cases of bud-rot were reported, but no fungus considered capable of being the primary cause of the trouble was isolated.

An interesting case of fruit rot was encountered, which may indicate one possible source of bud-rot disease. Some large bunches of fruits were received on which the fruits from the apex to the centre of the bunch were rotted. The rotted portion extended as far as the stalk of the bunch. It is possible that, if a parasitic fungus were at work, it might gain access through the fruit stalk to the main stem and from there attack and rot the bud. Mealy bugs were present on these fruits in large numbers accompanied by *Gloeosporium* sp. and bacteria. It is thought that injuries caused by the insects afforded a means of entry to the other organisms likely to produce the actual rotting of the fruit.

A synopsis of the insects affecting the oil palm was contributed to the account of the oil palm in Malaya referred to above. Observations have shown that, in the absence of control measures, the two well-known coconut pests, Black Beetles (*Oryctes rhinoceros*) and Red Stripe Weevils (*Rhyncophorus schach*), working in conjunction, may prove capable of causing serious damage on oil palm estates. Attention should, therefore, be paid on estates to the destruction of such breeding grounds of the beetle as are afforded by heaps of pericarp refuse and similar accumulations of decaying vegetable matter, while all wounded surfaces, such as those made in pruning, should be promptly protected with a thick coating of tar,

MINOR CROPS.

29. STATISTICS.—The cultivated areas under minor crops in the Federated Malay States, the Straits Settlements, Johore and Kedah are approximately as shown in the table given in Appendix C.

A.—FOOD CROPS.

30. TAPIOCA.—Johore (14,000 acres) and Kedah (7,638 acres) remain the principal States in which this crop is now cultivated. Local prices during the year have risen steadily from \$5.20 to \$9.35 per picul for flake and from \$8.30 to \$9.50 per picul for pearl. Though certain old areas in Johore have been removed, causing a temporary reduction of output, new areas are being opened up. The export for 1927 from Malaya was 35,139 tons valued at \$4,243,992.

Experiments were continued at Serdang to determine the number of crops which can be taken off the land (a) without manuring, (b) with green manures, (c) with artificial manures. Chemical analyses have been made of samples of root, stems and leaves from these plots in order to determine the quantities of potash, phosphates, calcium and nitrogen removed from the soil by the plants under these different methods of treatment.

The chemical work has led to an investigation of the efficiency of methods available for sampling a standing crop.

A paper, showing the comparative yields of certain imported and local varieties of tapioca, was published in the *Malayan Agricultural Journal*, Vol. XV, page 41.

31. MAIZE.—Breeding experiments were continued with 27 selected types, inbred for five generations. Selections from these have recently been planted for crossing with a view to obtaining good commercial types for field trials.

32. MISCELLANEOUS FOOD PLANTS.—Selection work on Soya beans and ground nuts is yielding satisfactory results. Trials of local and imported varieties of different food plants are being continued at Serdang.

B.—FRUIT.

33. PINEAPPLES.—The following were the exports of canned pineapples from Malaya during the last three years:

| | 1925. | | 1926. | | 1927. |
|----------------------|-----------|-----|-----------|-----|-----------|
| Weight in tons ... | 43,207 | ... | 40,634 | ... | 40,134 |
| Value in dollars ... | 8,236,824 | ... | 7,669,784 | ... | 8,296,656 |

Interest in this crop appears to be well maintained. There are approximately 25,000 acres planted with pineapples in Johore where six factories are in operation. Three factories working in Singapore obtained most of their supplies of fruit from Johore, while the factory in Selangor was supplied with locally grown fruit occupying an area of about 2,600 acres.

The market experienced many vicissitudes during the year. At one time there was an accumulation of stocks, but sales increased in the later months thereby easing the situation. Recent advice is that prospects have improved, although supplies are plentiful.

Two consignments of pineapple suckers received for planting at Serdang consisted of the Ripley Queen variety from the Department of Agriculture, Fiji, and the Smooth Cayenne variety from the Department of Agriculture, Hawaii.

Chemical investigations have shown that alcohol, or concentrated syrup, in addition to a cattle food, or manure, can be prepared from the parings, which at present accumulate in refuse heaps and become a source of danger as breeding grounds for insect pests.

34. BANANAS.—The supply of bananas has been barely sufficient to meet the local demand and there has been some extension of the area planted, particularly in the Negri Sembilan.

This department further co-operated with the Royal Botanic Gardens, Kew, and the Imperial College of Tropical Agriculture, Trinidad, in an attempt to produce a variety of banana, with good market qualities, resistant to the important Panama disease. A trial shipment of suckers from the collection of local varieties, now well established at Serdang, reached Kew in good order and germinated well in the quarantine house. Further shipments can be made as required, suckers being subsequently transmitted to Trinidad after quarantine at Kew.

A local survey has revealed the presence of three banana diseases, of which one, attacking the local "Pisang Embun", has certain symptoms similar to Panama disease. The occurrence of this local disease on "Pisang Embun" is significant, since this variety is thought to be identical with the West Indian commercial variety "Gros Michel," which is particularly susceptible to Panama disease. A species of the fungus *Fusarium* was isolated from the local disease of "Pisang Embun" and is being compared with a type culture recently received from Manila of *Fusarium cubense*—the cause of Panama disease.

35. OTHER FRUITS.—The mid-season fruit crop was very small, but at the end of the year in most places a good crop was either being harvested, or was approaching maturity.

With the objects of planting up an orchard at Serdang, and satisfying the local demand for planting material, a fruit nursery was fully stocked on the plantation early in the year.

Information has been collected concerning the insects attacking Citrus fruits in Malaya. The most serious pest is a moth, *Prays citri*, the caterpillars of which bore into the rind of the fruit and form galls. This insect would undoubtedly prove the limiting factor to successful citrus cultivation on a large scale and, in consequence, the problem of its control will receive attention.

C.—BEVERAGES.

36. COFFEE.—There has been an increase in the area planted with coffee during the year, but a very considerable further increase is necessary to supply the local market, as is shown by the fact that the net imports of coffee into Malaya for 1927 were valued at over two and a quarter million dollars. In addition to the local market, there would appear to be good prospects of business with other countries, particularly Australia where coffee imported from British territories has recently been granted the advantage of a preferential tariff.

37. TEA.—Some interest has been shown in the possibility of developing the local cultivation of tea. Certain imported varieties are growing well at Serdang and at the new Experimental Plantation on Cameron's Highlands. One lowland estate is exporting to England the produce of a comparatively small area. Local consumption in 1927 amounted to nearly ten million pounds in weight, valued at over four million dollars. Consequently a considerable local market awaits growers in Malaya, provided that they can produce tea of the grades desired. The world demand for high quality tea is increasing and there appears to be no reason why this country should not have a share in its production.

D.—FIBRES.

38. SISAL HEMP.—The possibility of the commercial production of this crop locally has attracted attention during the year.

An experiment was started at the Government Experimental Plantation, Serdang, with the object of ascertaining the optimum interval that should elapse between successive harvests of leaves, with reference both to the yield of dry fibre and to its quality and tensile strength. Another experiment in progress is intended to test the relative values of bulbils and suckers when used as planting material.

39. MAURITIUS HEMP.—A crop of leaves was being harvested at the end of the year and about 2½ tons of fibre, forming part of a trial consignment, had been baled in readiness for shipment to London.

40. TERAP BAST (*Artocarpus Kunstleri*).—Work on this fibre has now been completed and it has been shown to be unsuitable as a substitute for jute in the manufacture of a coarse yarn. There remains the possibility that this bast would form a useful raw material for paper, if available in adequate quantities.

E.—MISCELLANEOUS CROPS.

41. ARECA NUTS.—The production of areca nuts is an important industry in Johore and, to a lesser extent, in certain other parts of the country. There was some decline in this production during the year, accompanied by a fall in price, since the heavy rains at the end of 1926 and the beginning of 1927 adversely affected both the quantity and quality of the local produce.

Yields of individual trees have been recorded at Serdang during the year, and young palms of twenty different types have made good growth at the Coconut Selection Station, Klang. Thus, a basis for selection work with a view to improved yields is being established.

The Hispid beetle, *Wallacea palmarum*, appears to be a pest of some importance on areca palms and is somewhat difficult to control. These palms are also liable to destruction by what appears to be a root disease, of which the primary cause has not yet been positively ascertained.

42. GAMBIER.—Johore, the principal producing State, exported 19,138 piculs of gambier during the year. The price continued to decline from about \$8.40 to about \$7.50 per picul for block gambier and from \$17 to about \$14 per picul for cubes.

Experiments are in progress at Serdang to test the effect of different intervals between successive harvests on the yield and the tannin content of the leaves.

43. NIPAH.—The palms on the two existing estates continued to make satisfactory progress and the planted area was increased.

The investigations on the production of alcohol from nipah palms were concluded and the results were published in the *Malayan Agricultural Journal*, Vol. XV, No. 12.

Apart from the production of power alcohol, the nipah palm has potentialities as a source of acetic acid.

44. TUBA.—(*Derris elliptica*, *M. tuba puteh*, and *D. malaccensis*, *M. tuba merah*). This comparatively little known insecticide is engaging the attention of investigators in various countries. Samples and trial shipments have been despatched, which it is hoped will eventually lead to established markets in different parts of the world.

As was anticipated in the last report, the area planted with this crop in Johore has been extended, so that it now comprises about 1,400 acres. In the Federated Malay States there are over 700 acres under tuba.

A study has been commenced of the insecticidal value of different varieties of tuba. The toxic values obtained at Rothamsted with ethereal extracts of the dry root are being compared with those obtained with aqueous extracts of fresh roots, of known age, grown on the plots at Serdang.

45. CHAULMOOGRA OIL.—*Hydnocarpus Wightii*, *H. anthelmintica* and *Taraktogenos Kurzii*, the three trees from the fruits of which this oil is obtained, have continued to grow satisfactorily at Serdang. Further supplies of seed of the last two species have been obtained for the purpose of extending the planted area.

46. The possibility of producing ginger on a commercial scale is being investigated, since this plant grows well in Malaya. The shortage of supplies of pepper resulting in the present high price, appears worthy of the attention of those having some knowledge of its cultivation.

STOCK.

47. GENERAL.—Floods and disease caused a serious loss of buffaloes and sheep in Pahang, while in many other districts these same factors were responsible for a decrease in the number of stock during the year.

48. STOCK FARM AT SERDANG.—Considerable progress has been made in establishing a stock farm at the Government Experimental Plantation, Serdang, with the object of carrying out preliminary experiments in the breeding of milch cattle. The herd now consists of nine pure-bred Montgomery cattle, with three calves born during the year, and one pure-bred Jersey bull, making 13 head in all. The animals have all thrived well and have been fed entirely on locally grown foodstuffs. A substantial cattle shed and food store has been erected to house them.

A Poland-China boar was received from Manila at the close of the year. It is intended to use this animal for the improvement of local Chinese pigs.

49. FODDER AND GRAZING GRASSES.—The preliminary results obtained with various fodder and grazing grasses grown on the Government Experimental Plantation, Serdang, have been satisfactory. The information at present available was published as Circular No. 1/27 entitled "Fodder and Grazing Grasses."

SOILS.

50. GENERAL.—In February a composite Division of Soils and Plant Physiology was created under the charge of the Plant Physiologist, with Mr. J. H. Dennett as Assistant Chemist (Soils).

It has been found that many routine operations required for this work can satisfactorily be carried out by Laboratory Attendants working directly under trained Malay Officers. The employment of such attendants has greatly increased the capacity for work of the division at very small cost.

The work of the division during the year has been on soils rather than on plant physiology, the former presenting the more urgent problems. Reliable information concerning soils in the tropics, comparable with that available in respect of soils in temperate countries, is now generally regarded as of primary importance to the development of tropical agriculture throughout the Empire, more especially because it is very uncertain to what extent knowledge of soils gained in temperate countries will apply under tropical conditions.

51. RESEARCH WORK.—The field for soil work in Malaya is virgin to an exceptional and embarrassing degree. Not only have no systematic investigations hitherto been carried out, but, as far as the rolling or hilly inland soils (the backbone of the country) are concerned, there is absolutely no information as to their cultural characteristics, that could be used as a basis of research. The reason for this is that our only inland large scale crop, rubber, is remarkably tolerant of a wide range of soil conditions and that manuring of rubber has never been practised.

The most urgent problem appeared to be that of systematics, that is the establishment of soil types and the relating of these types to the underlying parent material.

Next in order came the question of the fertility of padi soils. In addition to these main lines of work, a number of other problems were somewhat cursorily examined with the idea of finding useful lines of attack for the future.

52. SOIL TYPES.—To characterise types it was decided to carry out a soil survey of a limited and accessible area. The area selected was a strip in Selangor running from Cheras, through Serdang, along the Klang valley to the coast. This area has the advantage of including all the important geological formations on the west side of the Peninsula and also of including the Government Experimental Plantation at Serdang.

At the end of the year the survey had reached the Ayer Hitam Forest Reserve, and a fairly complete idea of the distribution of what may be called the "upland" soil types in the area chosen had been obtained.

Five hundred and twenty-seven samples, representing one hundred and twelve profiles, have been collected and their mechanical analyses completed; of these 281 samples were taken on the Experimental Plantation.

53. PADI SOILS.—In view of the importance of sources of food supply, it was decided in May to undertake a comprehensive survey of padi soils with a view to ascertaining the soil factors affecting fertility. It was arranged that the Field Division should assist by collecting the samples and providing estimates of yields. Up to the end of the year 103 samples, chiefly from Malacca, had been received.

No correlations have yet been established between yield and any factor; in view of the small number of samples so far examined and the large influence of external conditions this is not surprising. It is hoped that the examination of a much larger number of samples and statistical treatment may reveal such correlations.

One observation of importance which has emerged is that the presence of a medium, or even high, percentage of sand does not necessarily result in low yield; great caution must, therefore, be used in condemning any proposed padi area on the score of a high sand-clay ratio.

Analyses were made of a number of samples of soil deposited by floods in Pahang. Most of the deposits were silty in nature and some contained more calcium (a good index of degree of leaching) than usual. The opinion was expressed that, if adequate water supplies could be secured, there was no reason to anticipate difficulty in growing padi on these deposits. In actual fact bumper harvests have been obtained from some of the areas.

54. COCONUT SOILS.—Attention has been paid, as already stated, to areas on which salmon pink disease of coconuts has occurred. The soils have been examined for pH value, nitrates, mechanical composition, and soluble iron and aluminium. No factor common to all the diseased patches has been found. Work is, however, being continued.

55. COVER CROPS.—Field examination of the roots of some imported leguminous covers showed a distinctly sparse development of nodules and threw doubt on the usual claim to extensive nitrogen enrichment by the use of such covers. Sand cultures were, therefore, started and are in progress.

MISCELLANEOUS INVESTIGATIONS.

56. CHEMICAL INVESTIGATIONS.—In addition to the research work already indicated in connection with the crops mentioned above, the following problems received attention, those relating to Jelutong (*Dyera costulata* and *D. laxiflora*), and the bark of the mangrove, being undertaken on behalf of the Forest Department.

A study has been made of the rotting of waste vegetable matter to produce manure. Work has followed lines similar to the investigations on A.D.C.O. products in England. Small trials have demonstrated that it is possible so to control the rotting of pineapple waste, sisal hemp waste or padi straw, that innocuous products, similar in character to soil humus, are produced without the addition of a proprietary activator.

A satisfactory method of coagulating jelutong latex by boiling has now been worked out and is being adopted by Chinese producers. Jelutong prepared in this way commands a premium on the market. Of the two kinds of deterioration common to native jelutong, the development of blackening has been overcome and the resinification and granulation observed in some lots are being investigated, to determine whether they are due to particular characteristics of the latex, or are induced by contamination with metallic salts. (*Malayan Agricultural Journal*, Vol. XV, pp. 65 and 400).

Data are being collected to show the tannin content of different kinds of mangrove bark in different places. This work has necessitated the investigation of methods for routine laboratory determinations of the extractable solids in the bark.

An investigation has been commenced on the efficiency of the local methods of distilling alcohol from rice. The results so far obtained disclose a serious waste of rice, in consequence of which the possibility of introducing improvements, practicable by the local distillers, will be examined.

57. MYCOLOGICAL INVESTIGATIONS.—In addition to the work on crop diseases already recorded, certain other matters of interest have been investigated.

As has been stated above, work on species of *Phytophthora* and *Pythium*, isolated from various crops in Malaya, has been continued. Much interesting information has been obtained, but further work is still necessary before definite results can be published.

Work on sclerotial diseases caused by *Sclerotium Rolfsii* was continued. An outbreak of disease on Sireh (*Piper Betle*) was found to be due to this fungus. Several host plants have now been recorded and comparative studies are being made of the different strains of *Sclerotium Rolfsii* obtained from them.

A disease attacking the radicles of mangrove seedlings (*Rhizophora* sp.) was reported by the Forest Department. This is being studied. A *Fusarium* sp. has been found to be associated with the trouble.

Specimens of a serious disease of the important hard wood tree *Balanocarpus Heimii*, M. Chengal, were forwarded by the Forest Department in November. The causative fungus is a large Fomes (*F. senex?*), which produces a chocolate-brown rot of the wood and renders it unfit for use as timber.

58. ECONOMIC INVESTIGATION.—SHELL CHARCOAL.—As a result of an opinion, expressed at the International Rubber Exhibition 1927, that a market awaited steady supplies of shell charcoal—employed for purposes such as the purification of liquids—an investigation was made of the possibility of obtaining supplies of such charcoal from oil palm and coconut shells. It was decided that oil palm shells were too valuable for use as fuel to permit of their export as charcoal. In the coconut industry, however, there is a surplus of about 30 per cent. of the shell after supplying all the fuel required for drying copra. In the aggregate, therefore, the coconut industry of Malaya might be able to supply a considerable quantity of shell charcoal, if the market is as firm as was at first reported. Figures have been collected of the actual cost of production and marketing; the result of further enquiries in Europe by the Malay States Information Agency is awaited.

GENERAL.

59. CAMERON'S HIGHLANDS.—Steady progress has been made in the opening up of the plantation which is situated at Tanah Rata in the south-eastern corner of the Highlands at an elevation of approximately 4,800 feet. The area felled and burned now comprises 80 acres, a considerable portion of which has been stumped and cleared of timber.

The principal object of this plantation is to carry out experiments with such upland crops as tea, cinchona, cardamoms and coffee, but attention is also being given to the cultivation of sub-tropical fruits, vegetables and ornamental plants.

Several varieties of tea, both species of cinchona (*C. Ledgeriana* and *C. succirubra*) and Kents Arabica coffee have been planted out in the field plots. The nursery has been extended and an area of $1\frac{1}{2}$ acres is now well stocked with seedlings of many kinds.

Pests, though fairly numerous, have not done much harm to the permanent crops, but cut worms (*Rhyacia ypsilon*) have caused serious damage in the vegetable beds. Collecting the larvae has been the only satisfactory means of control.

60. FRUIT DISTRIBUTION AND DEMONSTRATION STATIONS.—The Kuala Kangsar Experimental Plantation has been reorganised and is now being developed as a station for supplying planting material of good types of various fruit trees. It will also serve for demonstration purposes. Similar stations, though of smaller area, were opened during the year on land adjoining the quarters of the Agricultural Field Officers at Seremban and Kuala Lipis. Some of the fruit trees at the Pekan Station were destroyed by the floods, but fortunately a number survived. Additions will be made as good material for planting becomes available. During the year this station served a useful purpose for raising stocks of vegetable seeds, and other planting material, for distribution among the owners of holdings which had been severely damaged by the floods.

61. AGRICULTURAL SHOWS.—The Malayan Agri-Horticultural Association held its fifth annual exhibition at Kuala Lumpur from July 29th to August 1st. As usual, the Department of Agriculture prepared a special exhibit, the principal features of which were a comprehensive collection of fodder grasses and an exhibit of Nipah. The Johore Government, through their Inspector of Agriculture, added an instructive exhibit illustrating the cultivation and preparation of gambier.

Eight district shows were held during the year, five in the Federated Malay States, two in the Colony and one in Perlis, all but the last being conducted under the auspices of the Malayan Agri-Horticultural Association.

The interest aroused by all these shows has continued to effect an improvement in the quality of exhibits and has also provided an incentive to the importation of good breeds of live stock, particularly poultry.

62. INCORPORATED SOCIETY OF PLANTERS' CONFERENCE.—Two papers were read at the Conference held on August 15th and 16th in Penang under the auspices of the Incorporated Society of Planters. These were "Catch Crops" by Messrs. Bunting and Milsum and "The Preparation of Oil Palm Products" by Major Georgi.

63. AGRICULTURAL INSTRUCTION.—Of the apprentices in training at the department 16 second-year students qualified for promotion to the grade of Junior Agricultural Assistant, while one was appointed Assistant Artist. Two of the successful students returned to Johore and one to Kedah to commence their service, since the department is permitted to accept for training a limited number of students selected by the Governments of the Unfederated Malay States.

At the end of the year there were nine second-year students and 13 first-year students in training. Of the latter three came from Johore and one from Kedah.

Unfortunately, it was not found possible to continue the instruction in typewriting which previously formed part of the curriculum. The lectures in English given by the students themselves and the English debates were maintained and a small English library was instituted.

64. AGRICULTURAL SCHOOL.—The report of the Committee appointed in 1926 to draw up a scheme for a School of Agriculture was approved in principle. A site of 22 acres, adjoining the Government Experimental Plantation at Serdang, was selected for the school. Its preparation was commenced in September and by the end of the year the jungle on it had been felled, burned and cleared.

An Advisory Committee for the school was appointed towards the end of the year, with the Secretary for Agriculture as Chairman and the Agricultural Instructor (Malay Officers) as Secretary. This Committee met on the 30th November to consider details. Preliminary plans and estimates for the lay-out and buildings were tabled at the meeting and were subsequently submitted to Government along with the Committee's recommendations on these and other matters.

65. SCHOOL GARDENS.—On the whole satisfactory progress has been made in school gardens everywhere, some of the best being found in Malacca, Penang and the Negri Sembilan. Many of those along the Pahang River were destroyed by the floods, but most have since been re-established.

66. LIBRARY AND PUBLICATIONS.—The work of the library continued to run smoothly and some of the arrears of binding were overtaken.

The fifteenth annual volume of the *Malayan Agricultural Journal* was published in 12 monthly numbers of which numbers 9 and 10 were reprinted as Special Bulletin No. 39—"The Oil Palm in Malaya." The number of sales of complete volumes of the Journal amounted to 258 together with 424 single numbers, in addition to 217 copies of Special Bulletins.

Four quarterly numbers, completing the fifth volume, of the Malay publication *Warta Perusahaan Tanah* were published. This publication is now well established and its normal circulation has increased by 500 copies per issue, so that it now stands at 3,500 copies per issue.

The publication by the department of the Chinese Agricultural Journal commenced in June, the first volume being completed in three parts. Five thousand copies of each part were printed. The reception given to this Journal has been so encouraging that the growing demand is expected to justify the printing of a larger number of copies in the near future. Letters of enquiry on various agricultural subjects have been received from readers in countries as far apart as Brunei and Siam.

67. RESTORATION WORK IN AREAS DEVASTATED BY THE FLOODS.—Early in the year it became possible to estimate the damage caused by the severe floods at the end of 1926 in the valleys of the Perak, Pahang and Kuantan rivers.

In the valley of the Perak River, the padi over about 8,500 acres was completely destroyed, as were a number of fruit trees. Rubber did not suffer heavily and no great depth of silt was deposited anywhere.

Along the Pahang River practically the whole of the padi, both growing plants and stored grain, was swept away. A large portion of the wet padi land was buried under a layer of detritus which varied in depth from a few inches to as much as five feet. This detritus was subsequently analysed and considered to be suitable for padi planting, a conclusion which was supported by the heavy crops obtained towards the end of the year. A number of fruit trees and coconut palms were destroyed and, in some cases, rubber trees also were killed or swept away.

In February applications were received for large quantities of planting material of quick growing vegetable and food crops. With the aid of the Consul General of the Netherlands, 350 piculs of maize seed were obtained from Java and were distributed. A quantity of seed of beans and other vegetables and a number of cuttings of tapioca and sweet potatoes were also supplied to Pahang. These supplies were intended for planting on land above the level of the subsiding water and of the deposits of detritus. The latter were still almost liquid and extended for a considerable width along either bank of the Pahang River.

Three special leaflets were prepared in Malay and English for distribution with the planting material. These were entitled:

"Cultivation and Cooking of Maize and Preparation of 'Gaplek' from Tapioca."

"Advice to Malays in Pahang."

"Cultivation of Hill Padi."

During February and March 96,000 gantangs of seed of both "dry" and "wet" padi were purchased in various parts of the country and distributed in the damaged areas, more than half being used in Pahang.

Unfortunately, along the Perak River sickness and unfavourable weather conditions resulted in hardly any return from the padi seed supplied.

In Pahang a second minor flood washed away some of the earlier plantings made, and a subsequent drought damaged the dry padi and maize. A portion of the vegetables and maize survived, however, and was used for further planting later, being supplemented by material distributed from the Experiment Station at Pekan. Many good vegetable gardens were to be seen in the kampongs along the river during August, more especially in Pekan district.

In the last quarter of the year, after the work of planting up vegetables and padi for immediate food requirements had been completed, supplies of seed coconuts and young fruit trees were distributed in Pahang to replace some of those destroyed.

The Malays in Pahang worked hard to overcome their misfortunes with a satisfactory measure of success, so that the recovery of the country along the river was more rapid than could at first be anticipated.

DEPARTMENT OF AGRICULTURE,

KUALA LUMPUR,

11th May, 1928.

F. W. SOUTH,

Acting Secretary for Agriculture, S.S. and F.M.S.

APPENDIX A.

STAFF.

1. SECRETARY FOR AGRICULTURE.—Mr. B. W. Elles, M.C.S., was in charge of the Department as Acting Secretary for Agriculture from the 1st January to the 10th March. Mr. F. W. South held the acting appointment from March 11th to May 5th, from August 27th to November 14th and on December 31st. Mr. A. S. Haynes, M.C.S., resumed his substantive appointment as Secretary for Agriculture from May 6th to August 26th and Mr. A. J. Sturrock, M.C.S., acted from November 15th to December 30th.

2. ASSISTANT TO SECRETARY FOR AGRICULTURE.—Mr. D. H. Grist (Agricultural Economist) acted throughout the year in addition to his own duties. Mr. W. N. C. Belgrave was Editor of the *Malayan Agricultural Journal*.

3. CHEMICAL DIVISION.—Mr. R. O. Bishop, M.B.E., acted as Agricultural Chemist during the year, in place of Major B. J. Eaton, O.B.E., who remained seconded to the Rubber Research Institute.

ASSISTANT AGRICULTURAL CHEMISTS.—Mr. R. O. Bishop, M.B.E., Major C. D. V. Georgi, O.B.E., Mr. V. R. Greenstreet, Mr. J. H. Dennett (transferred to the new Division of Plant Physiology and Soils on February 14th.)

ASSISTANT ANALYST.—Mr. Gunn Lay Teik.

4. FIELD DIVISION.—Mr. F. W. South (Chief Agricultural Field Officer) was in charge from January 1st to March 10th, from May 6th to October 9th and from November 15th to the end of the year. Mr. F. Birkinshaw (Agricultural Field Officer, Perak North) acted as Chief Agricultural Field Officer in addition to his own duties from March 11th to May 5th and October 10th to November 14th, while Mr. South was acting as Secretary for Agriculture.

AGRICULTURAL FIELD OFFICERS.—These officers were distributed among the various States as follows:

Perak North.—Mr. F. Birkinshaw.

Perak South.—Mr. A. E. Coleman Doscas.

Selangor.—Mr. R. B. Jagoe up to October 17th inclusive; Mr. C. L. Newman, with effect from October 18th.

Negri Sembilan.—Mr. W. H. Barnes (temporary Agricultural Field Officer).

Pahang West.—Mr. J. W. Jolly.

Pahang East.—Captain J. M. Howlett, M.C.

Province Wellesley and Penang.—Mr. F. R. Mason.

Malacca.—Mr. J. Fairweather.

Singapore.—The Chief Field Officer in addition to his own duties.

Johore.—Mr. F. de la M. Norris acted as Inspector of Agriculture throughout the year.

Mr. C. L. Newman was appointed an Agricultural Field Officer on September 17th and reported for duty in Selangor on October 18th.

Messrs. R. G. Heath and J. A. Craig were appointed Agricultural Field Officers on October 7th and reported for duty on November 3rd. The former assisted the Agricultural Field Officer, Perak North, and the latter the Agricultural Field Officer, Negri Sembilan, whilst gaining experience of their duties.

5. MYCOLOGICAL DIVISION.—Mr. A. Sharples (Mycologist) was in charge until April 27th after which date he was on leave until the end of the year. Mr. A. Thompson (Assistant Mycologist) was in charge during the absence of Mr. Sharples.

ASSISTANT MYCOLOGISTS.—Mr. A. Thompson and Mr. F. S. Ward.

6. ENTOMOLOGICAL DIVISION.—Mr. G. H. Corbett (Government Entomologist) was in charge of the Division throughout the year.

ASSISTANT ENTOMOLOGIST.—Mr. C. Dover (transferred from the Museums Department) acted temporarily from June 1st to the end of the year.

7. DIVISION OF PLANT PHYSIOLOGY AND SOILS.—This Division was reconstituted on February 14th to include work on soils. Mr. W. N. C. Belgrave (Plant Physiologist) was in charge throughout the year.

ASSISTANT CHEMIST (SOILS).—Mr. J. H. Dennett, from February 14th until the end of the year.

8. BOTANICAL DIVISION.—Dr. H. W. Jack (Economic Botanist) was in charge of the Division throughout the year.

ASSISTANT BOTANISTS.—Mr. W. N. Sands, Mr. R. B. Jagoe (transferred from the Field Division on October 18th).

AGRICULTURAL DIVISION.—Mr. B. Bunting (Agriculturist) was in charge of the Division throughout the year. Mr. F. G. Spring (Agriculturist, Rubber) was seconded for service in the Co-operative Societies Department on May 1st.

9. ASSISTANT AGRICULTURISTS.—Mr. J. N. Milsum, Mr. E. A. Curtler (on leave till March 14th), Mr. T. D. Marsh, Mr. J. Lambourne (on leave from July 16th).

SUPERINTENDENT GOVERNMENT PLANTATIONS, KUALA LUMPUR.—Mr. A. L. Sinclair (temporarily employed), left the service on February 20th. The duties of the appointment were later performed by Mr. H. Ritchings (Horticultural Assistant) who reported for duty on June 2nd.

Mr. F. S. Banfield was also appointed a Horticultural Assistant and reported for duty on June 27th.

10. ECONOMIC DIVISION.—Mr. D. H. Grist (Agricultural Economist) was in charge throughout the year.

11. AGRICULTURAL INSTRUCTION (MALAY OFFICERS).—Mr. G. E. Mann, M.C. (Agricultural Instructor, Malay Officers) was in charge throughout the year.

ASSISTANT AGRICULTURAL INSTRUCTOR.—Raja Mahmud bin Raja Ali.

12. LIBRARY.—Mr. L. A. Rijk was in charge of the Library throughout the year.

13. The substantive appointments of two Assistant Entomologists, the Superintendent of Government Plantations and one Botanical Research Student were not filled throughout the year.

14. The Secretary for Agriculture, Mr. A. S. Haynes, M.C.S. and the Mycologist, Mr. A. Sharples, represented the Department at the Imperial Agricultural Research Conference held in London during October and November.

APPENDIX B.

SUMMARY OF PADI RETURNS—BRITISH MALAYA. SEASON 1926-1927.

The yields are given in gantangs (gallons) of padi.

| State. | Wet. | | Dry. | |
|---------------------------|----------|-------------|----------|-----------|
| | Acreage. | Yield. | Acreage. | Yield. |
| FEDERATED MALAY STATES. | | | | |
| Perak | 88,839 | 12,431,297 | 3,081 | 281,653 |
| Selangor | 17,311 | 3,754,300 | 3,175 | 415,108 |
| Negri Sembilan | 30,759 | 3,098,126 | 10 | 800 |
| Pahang | 21,953 | 2,141,942 | 1,325 | 40,819 |
| Total F.M.S. | 158,862 | 21,425,665 | 7,591 | 738,380 |
| Krian | 54,362 | 9,493,654 | — | — |
| STRAITS SETTLEMENTS. | | | | |
| Singapore | — | — | — | — |
| Penang | 5,060 | 2,129,250 | — | — |
| Malacca | 25,409 | 8,303,706 | — | — |
| Province Wellesley | 39,050 | 8,600,000 | — | — |
| Dindings* | 400 | 40,000 | 330 | 33,000 |
| Total S.S. | 69,919 | 19,072,956 | 330 | 33,000 |
| UNFEDERATED MALAY STATES. | | | | |
| Johore | 3,756 | 167,840 | 1,395 | 172,991 |
| Kedah | 164,817 | 54,409,206 | 6,940 | 1,864,807 |
| Perlis | 36,432 | 8,916,600 | 45 | 13,440 |
| Kelantan | 116,887 | 13,030,000 | 57,050 | 5,721,000 |
| Trengganu | 8,000 | 1,000,000 | 4,000 | 400,000 |
| Total U.M.S. | 329,892 | 77,523,646 | 69,430 | 8,172,238 |
| Total F.M.S. | 158,862 | 21,425,665 | 7,591 | 738,380 |
| „ S.S. | 69,919 | 19,072,956 | 330 | 33,000 |
| „ U.M.S. | 329,892 | 77,523,646 | 69,430 | 8,172,238 |
| Malaya | 558,673 | 118,022,267 | 77,351 | 8,943,618 |

* Returns not available so that figures for previous year are given.

APPENDIX C.
ACREAGE OF MISCELLANEOUS CROPS IN MALAYA.

| State. | SECONDARY CROPS. | | | MINOR CROPS. | | | | | | | |
|-----------------------------------|------------------|------------|------------|--------------|-------------|---------|----------|---------|---------|-------|--------|
| | Tapioca. | Pineapple. | Oil Palms. | Nipah. | Areca Nuts. | Coffee. | Gambier. | Banana. | Derris. | Sago. | Kapok. |
| Selangor ... | 1,180 | 2,637 | 11,075 | 5,750 | ... | 5,443 | ... | ... | 40 | ... | 17 |
| Perak ... | 179 | 377 | 1,516 | 4,285 | 241 | 249 | ... | ... | 378 | 106 | 73 |
| Negri Sembilan ... | 293 | 149 | 600 | 413 | ... | 281 | 294 | 2,055 | 269 | ... | ... |
| Pahang ... | 300 | 3 | ... | ... | ... | 689 | 1,770 | ... | 57 | ... | 257 |
| Total F.M.S. ... | 1,952 | 3,166 | 13,191 | 10,448* | 241 | 6,662 | 2,064 | 2,055 | 744 | 106 | 347 |
| Penang and Province Wellesley ... | 433 | 644 | ... | 970 | 808 | 115 | 67 | ... | ... | ... | ... |
| Malacca ... | 230 | 212 | ... | ... | ... | 148 | ... | ... | ... | ... | ... |
| Singapore ... | ... | 1,000 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Total S.S. ... | 663 | 1,856 | ... | 970 | 808 | 263 | 67 | ... | ... | ... | ... |
| Johore ... | 14,000 | 25,000 | 5,130 | ... | 8,000 | ... | 3,000 | ... | 1,400 | 700 | 27 |
| Kedah ... | 7,638 | 544 | ... | ... | ... | 587 | ... | 1,960 | 3 | ... | ... |
| Total U.M.S. ... | 21,638 | 25,544 | 5,130 | ... | 8,000 | 587 | 3,000 | 1,960 | 1,403 | 700 | 27 |

* Including areas worked for "atap."



